

## Climatic Zones and Types

### Chapter 8

#### Early Classification Schemes

- **Greeks “known world”**
  - **Temperate Zone**
    - **Midlatitudes**
  - **Torrid Zones**
    - **Tropics to the south**
  - **Frigid Zone**
    - **Areas to the north**

#### Today’s Climate Zones

- **Equatorial warm-wet**
- **Tropical hot-dry**
- **Subtropical warm**
- **Warm Temperate**
- **Mid latitude cool temperate**
- **High-latitude cold**

#### Koppen Climate Classification System

- **Uses a database based on the average annual and average monthly values of temperature and precipitation**
- **Four of the five major climatic groups defined by temperature characteristics, fifth (the B class) is based on moisture.**
- **Subdivided on relationships of precipitation and temperature**

#### Modified Koppen System

- **Five Major Climate Groups**
  - **A, B, C, D, E**
- **Each Major Group subdivided into 14 individual climate types**
- **Special category of “highland” climate**

## Koppen Letter Code System

- **A Tropical Humid**
  - Low latitude, warm and wet
- **B Dry**
  - Evaporation exceeds precipitation
- **C Mild Mid-latitude**
  - Mild winters, warm or hot summers
- **D Severe Mid-latitude**
  - Severe, cold winters, cool summers
- **E Polar**
  - Very high latitude, cold climates
- **H Highland**
  - High mountains; elevation is dominant control

## Second letters

- **A, C, & D Climate Precipitation**
  - **f** – wet all year
  - **m** – monsoonal precipitation pattern (very wet summer)
  - **w** – winter dry season
  - **s** – summer dry season
- **B Climate Precipitation**
  - **W** – desert
  - **S** – steppe
- **E Climate Temperature**
  - **T** – tundra
  - **F** – ice cap
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## Third Letters

- **C and D Climates' temperature**
  - **a** – hot summers
  - **b** – warm summers
  - **c** – cool summers
  - **d** – very cold winters
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- **B Climate Temperature**
  - **h** –hot desert or steppe
  - **k** – cold desert or steppe

### **Tropical Humid Climate (Group A)**

- **Tropical Wet (Af)**
  - 5 -10 degrees of the equator
  - Warm all year
  - No dry season
  - Controlled by the trade wind convergence
- **Tropical savanna (Aw)**
  - Fringe of 25 degrees N or S
  - Warm to hot all year
  - Distinct wet and dry seasons
  - Seasonal shifting of tropical wind and pressure belts
- **Tropical monsoon (Am)**
  - Windward tropical coasts of Asia, Central and South America, Guinea Coast of Africa
  - Temperature similar to Af with a slightly larger Average Temperature Rate (ATR)
  - Very wet summer , short winter dry season
  - Seasonal wind direction reversal

### **Dry Climates (Group B)**

- **Subtropical desert (BWh)**
  - Very hot summers, relative mild winter
  - Rainfall Scarce
  - Subsidence from subtropical highs; cool ocean currents
- **Subtropical Steppe (BSh)**
  - Fringing BWh except on west
  - Centered at latitudes 25-30 on western sides of continents
  - Temperature similar to BWh but more moderate
  - Semiarid

- Similar to BWh
- **Mid latitude desert (BWk)**
  - Central Asia; western interior of United States; Patagonia
  - Hot summers, cold winters
  - Meager, erratic precipitation, mostly showery; some winter snow
  - Distant from sources of moisture; some rain shadow effects
- **Mid latitude steppe (BSk)**
  - Peripheral to BWk; transitional to more humid climates
  - Temperature similar to BWk but slightly more moderate
  - Semiarid; some winter snow
  - Similar to BWk

### **Mild Mid latitude Climates (Group C)**

- **Mediterranean (Csa, Csb)**
  - Centered at 35 latitude on western sides of continents, limited east-west extent except in Mediterranean Sea area
  - Warm/hot summers; mild winters; year-round mildness in coastal areas
  - Moderate precipitation annually, nearly all in winter; much sunshine, some coastal fog
  - Sub-tropical High subsidence and stability in summer; westerly winds and cyclonic storms in winter
- **Humid subtropical (Cfa, Cwa)**
  - Centered at 30 latitude on eastern sides of continents; considerable east-west extent
  - Summers warm/hot, sultry; winters mild to cold
  - Abundant precipitation annually, mostly rain; summer maxima but no true dry season
  - Westerly winds and storms in winter; moist onshore flow in summer; monsoons in Asia
- **Marine west coast (Cfb, Cfc)**
  - Latitudes 40-60 on western sides of continents; limited inland extent except in Europe
  - Very mild winters for the latitude; generally mild summers
  - Moderate to abundant precipitation, mostly in winter; many days with rain; much cloudiness
  - Westerly flow and oceanic influence year-round

## **Severe Mid latitude Climates (D Group)**

- **Humid continental (Dfa, Dfb, Dwa, Dwb)**
  - Northern Hemisphere only; latitudes 35-55, on eastern sides of continents
  - Warm/hot summers; cold winter; much day-to-day variations
  - Moderate to abundant precipitation annually; with summer maxima; diminishes interior-ward and pole-ward
  - Westerly winds and storms, especially in winter; monsoons in Asia
- **Subarctic (Dfc, Dfd, Dwc, Dwd)**
  - Northern Hemisphere only, latitudes 50-70 across North America and Eurasia
  - Long, dark, very cold winters; brief, mild summers
  - Meager precipitation annually, with summer maxima; light snow in winter but little melting
  - Pronounced continentality; Westerlies and cyclonic storms alternating with prominent anti-cyclonic conditions

## **Polar Climates (Group E)**

- **Tundra (ET)**
  - Fringes of Arctic Ocean; small coastal areas in Antarctica
  - Long, cold, dark winters; brief cool summer;
  - Very sparse precipitation annually, mostly snow
  - Latitude; distance from sources of heat and moisture; extreme seasonal contrasts in sunlight/darkness
- **Ice cap (EF)**
  - Antarctica and Greenland
  - Long, dark, windy, bitterly cold winters; cold windy summers
  - Very sparse precipitation, all snow
  - Latitude; distance from sources of heat and moisture; extreme seasonal contrasts in sunlight/darkness; polar anticyclones

## **Highland Climate (Group H)**

- High uplands (mountains and plateaus) with complex local climate variation in small areas
- Related closely to the adjacent lowland with regard to seasonality of precipitation
- Altitude variations influence all four elements of the weather and the climate of the highlands (vertical zonation)
- Exposure is another profound influence on the highland climate

## **Global Climate Change**

- **Determining Climate Change**
  - **Dendrochronology**
    - **Determining climate change through tree rings**
  - **Oxygen Isotope Analysis of Oceanic Sediments**
  - **Ice Cores**
    - **Analysis of the ratio of the water molecules weight.**
  - **Pollen Analysis (palynology)**
    - **Using radiocarbon dating on pollen matter found in sediment layers**

## **Causes of Long-Term Climate Change**

- **Volcanic Activity and Meteor Impacts**
- **Fluctuations in Solar Output**
- **Variations in Earth-Sun Relations (Milankovich cycles)**
  - **Change in the Earth's axis**
  - **Change in the "shape" of the Earth's elliptical orbit**
  - **Wobble in the Earth's axis**
- **Greenhouse Gases Concentration**
- **Feedback Mechanisms**
- **Roles of the Ocean**

## **Climate Models**

- **General Circulation Models (GCMs)**
  - **Used to determine future climate changes**
- **Evidences of Current Global Warming**
- **Consequences of Global Warming**